

WHAT IS CLAIMED IS:

1 1. An apparatus for mapping CELP parameters between a source codec
2 and a destination codec, the apparatus comprising:
3 an LSP mapping module;
4 an adaptive codebook mapping module coupled to the LSP mapping module;
5 a fixed codebook mapping module coupled to the LSP mapping module and
6 the adaptive codebook mapping module;
7 wherein the LSP mapping module comprises:
8 an LP overflow module configured to process information associated
9 with a plurality of interpolated LSP parameters and generate an overflow signal based on at
10 least information associated with the plurality of interpolated LSP parameters;
11 an LSP parameter modification module configured to modify at least
12 one frequency of at least one of the plurality of interpolated LSP parameters in response to
13 the overflow signal;
14 wherein the adaptive codebook mapping module comprises a first pitch gain
15 codebook, the first pitch gain codebook including a first plurality of entries, each of the first
16 plurality of entries including a plurality of terms and a plurality of sums associated with the
17 plurality of terms;
18 wherein the fixed codebook mapping module comprises:
19 a first target processing module configured to process a first target
20 signal and generate a first modified target signal;
21 a pulse search module configured to locate a first plurality of pulse
22 positions and signs for a plurality of pulses in a subframe based on at least information
23 associated with the first modified target signal;
24 a fixed codebook gain estimation module configured to estimate a
25 fixed codebook gain for the subframe based on at least information associated with the first
26 plurality of pulse positions and signs;
27 a pulse position searching module configured to receive the first
28 modified target signal, an impulse response signal and the estimated fixed codebook gain and
29 to output a second plurality of pulse positions and signs for the plurality of pulses.

- 1 2. The apparatus of claim 1 wherein the LSP parameter modification
2 module is further configured to increase or decrease the at least one frequency of the at least
3 one of the plurality of interpolated LSP parameters in response to the overflow signal.
- 1 3. The apparatus of claim 2 wherein the LSP parameter modification
2 module is substantially free from a degradation of a signal quality.
- 1 4. The apparatus of claim 2 wherein a decoder of the destination codec is
2 free from a signal overflow.
- 1 5. The apparatus of claim 1 wherein the plurality of terms are associated
2 with at least one element related to a first gain coefficient for a first tap of a pitch filter, and
3 the plurality of sums are associated with a plurality of products, the plurality of products
4 associated with at least a second gain coefficient for a second tap of the pitch filter and a third
5 gain coefficient for a third tap of the pitch filter.
- 1 6. The apparatus of claim 5 wherein the second tap of the pitch filter is
2 the same as the third tap of the pitch filter.
- 1 7. The apparatus of claim 1 wherein the adaptive codebook mapping
2 module is associated with a destination codec including a multi-tap pitch filter.
- 1 8. The apparatus of claim 1 wherein the pulse position searching module
2 comprises:
3 a single track pulse search module configured to locate at least one position
4 and one sign of at least one pulse in a first track;
5 a target update module configured to remove a contribution of the at least one
6 pulse from the first target signal and output a first updated target signal;
7 a second target processing module configured to receive the first updated
8 target signal and output a second modified target signal;
9 a buffer module configured to store the at least one position and one sign of
10 the at least one pulse in the first track and output the second plurality of pulse positions and
11 signs for the plurality of pulses.
- 1 9. The apparatus of claim 8 wherein the pulse position searching module
2 further comprises a track selection module configured to select the first track.

1 10. The apparatus of claim 1 wherein the fixed codebook mapping module
2 is associated with a fixed codebook, the fixed codebook being an algebraic fixed codebook or
3 a multi-pulse fixed codebook.

1 11. The apparatus of claim 1 wherein the fixed codebook mapping module
2 is associated with a destination codec including a sparse fixed codebook.

1 12. The apparatus of claim 1 wherein the LSP mapping module, the
2 adaptive codebook mapping module and the fixed codebook mapping module are associated
3 with a destination codec related to G.723.1.

1 13. The apparatus of claim 1, wherein the LSP mapping module, the
2 adaptive codebook mapping module and the fixed codebook mapping module are associated
3 with a destination codec related to GSM-AMR.

1 14. The apparatus of claim 1 wherein the LSP mapping module further
2 comprises:

3 an LSP quantization module configured to quantize the plurality of
4 interpolated LSP parameters based on at least information associated with a plurality of
5 quantization tables related to a destination codec;

6 an LSP decoder and stability check module configured to decode the
7 quantized plurality of interpolated LSP parameters.

1 15. The apparatus of claim 14 wherein the LSP decoder and stability check
2 module is further configured to process information associated with ordering and spacing
3 between a first parameter and a second parameter of the decoded plurality of interpolated
4 LSP parameters, the first parameter and the second parameter being adjacent to each other.

1 16. The apparatus of claim 1 wherein the adaptive codebook mapping
2 module further comprises:

3 an adaptive codebook target generation module configured to generate a
4 second target signal;

5 an adaptive codebook configured to store a plurality of excitation signals;

6 a candidate lag selection module configured to receive an open-loop pitch lag
7 and generate a candidate pitch lag value;

8 a candidate vector signal generation module configured to generate a plurality
9 of candidate signals based on at least information associated with the adaptive codebook and
10 the candidate pitch lag value;

11 an auto-correlation and cross-correlation module configured to calculate a set
12 of dot products of the second target signal and delayed versions of the plurality of candidate
13 signals or of the delayed versions of the plurality of candidate signals, and to output a vector
14 signal associated with at least the set of dot products;

15 a gain codevector selection module configured to receive the vector signal, to
16 estimate a dot product of an entry associated with the first pitch gain codebook and the
17 received vector signal, processing at least information associated with the dot product and a
18 predetermined value, and output an index of a selected codevector and an adaptive codebook
19 pitch lag associated with the selected codevector;

20 a buffer module to store the index of the selected codevector and the adaptive
21 codebook pitch lag.

1 17. The apparatus of claim 16 wherein the predetermined value is a
2 predetermined maximum value.

1 18. The apparatus of claim 16 wherein the first plurality of entries are
2 correlated to a second plurality of entries of a second pitch gain codebook of a destination
3 codec.

1 19. The apparatus of claim 16, wherein the vector signal is associated with
2 the plurality of terms and the plurality of sums.

1 20. The apparatus of claim 1 wherein the fixed codebook mapping module
2 comprises:

3 a fixed codebook target generation module configured to generate the first
4 target signal;

5 a codevector construction module configured to receive the second plurality of
6 pulse positions and signs, to generate a fixed codebook vector based on at least information
7 associated with the second plurality of pulse positions and signs, and to determine fixed
8 codebook indices for the subframe based on at least information associated with the second
9 plurality of pulse positions and signs.

1 21. The apparatus of claim 1 wherein the LSP mapping module, the
2 adaptive codebook mapping module, and the fixed codebook mapping module are configured
3 to operate independently of each other.

1 22. An apparatus for mapping LSP parameters between a source codec and
2 a destination codec, the apparatus comprising:

3 an LP overflow module configured to process information associated with a
4 plurality of interpolated LSP parameters and generate an overflow signal based on at least
5 information associated with the plurality of interpolated LSP parameters;

6 an LSP parameter modification module configured to modify at least one
7 frequency of at least one of the plurality of interpolated LSP parameters in response to the
8 overflow signal;

9 an LSP quantization module configured to quantize the plurality of
10 interpolated LSP parameters based on at least information associated with a plurality of
11 quantization tables related to a destination codec;

12 an LSP decoder and stability check module configured to decode the
13 quantized plurality of interpolated LSP parameters.

1 23. An apparatus for mapping adaptive codebooks between a source codec
2 and a destination codec, the apparatus comprising:

3 an adaptive codebook target generation module configured to generate a target
4 signal;

5 a pitch gain codebook, the pitch gain codebook including a plurality of entries,
6 each of the plurality of entries including a plurality of terms and a plurality of sums
7 associated with the plurality of terms;

8 a candidate lag selection module configured to receive an open-loop pitch lag
9 and generate a candidate pitch lag value;

10 a candidate vector signal generation module configured to generate a plurality
11 of candidate signals based on at least information associated with the adaptive codebook and
12 the candidate pitch lag value;

13 an auto-correlation and cross-correlation module configured to calculate a set
14 of dot products of the target signal and delayed versions of the plurality of candidate signals
15 or of the delayed versions of the plurality of candidate signals, and to output a vector signal
16 associated with at least the set of dot products;

17 a gain codevector selection module configured to receive the vector signal, to
18 compute a dot product of an entry associated with the pitch gain codebook and the received
19 vector signal, processing at least information associated with the dot product and a
20 predetermined value, and output an index of a selected codevector and an adaptive codebook
21 pitch lag associated with the selected codevector;
22 a buffer module to store the index of the selected codevector and the adaptive
23 codebook pitch lag.

1 24. An apparatus for mapping fixed codebooks between a source codec
2 and a destination codec, the apparatus comprising:
3 a fixed codebook target generation module configured to generate a target
4 signal;
5 a target processing module configured to process the target signal and generate
6 a first modified target signal;
7 a pulse search module configured to locate a first plurality of pulse positions
8 and signs for a plurality of pulses in a subframe based on at least information associated with
9 the first modified target signal;
10 a fixed codebook gain estimation module configured to estimate a fixed
11 codebook gain for the subframe based on at least information associated with the first
12 plurality of pulse positions and signs;
13 a pulse position searching module configured to receive the first modified
14 target signal, an impulse response signal and the estimated fixed codebook gain and to output
15 a second plurality of pulse positions and signs for the plurality of pulses;
16 a codevector construction module configured to receive the second plurality of
17 pulse positions and signs, to generate a fixed codebook vector, and to determine the fixed
18 codebook indices for the subframe.

1 25. The apparatus of claim 23 wherein the pulse position searching module
2 comprises:
3 a single track pulse search module configured to locate at least one position
4 and one sign of at least one pulse in a first track;
5 a target update module configured to remove a contribution of the at least one
6 pulse from the first target signal and output a first updated target signal;

7 a second target processing module configured to receive the first updated
8 target signal and output a second modified target signal;
9 a buffer module configured to store the at least one position and one sign of
10 the at least one pulse in the first track and output the second plurality of pulse positions and
11 signs for the plurality of pulses.

1 26. A method for mapping CELP parameters between a source codec and a
2 destination codec, the method comprising:

3 receiving a plurality of interpolated LSP parameters, a plurality of interpolated
4 adaptive codebook parameters, and a plurality of interpolated fixed codebook parameters;

5 generating a plurality of quantized LSP parameters based on at least
6 information associated with the plurality of interpolated LSP parameters;

7 generating a plurality of quantized adaptive codebook parameters based on at
8 least information associated with the plurality of interpolated adaptive codebook parameters;

9 generating a plurality of quantized fixed codebook parameters based on at
10 least information associated with the plurality of interpolated fixed codebook parameters;

11 wherein the generating a plurality of quantized LSP parameters comprises
12 generating an overflow signal based on at least information associated with the plurality of
13 interpolated LSP parameters;

14 wherein the generating a plurality of quantized adaptive codebook parameters
15 comprises estimating a dot product of an entry associated with a pitch gain codebook and a
16 vector signal, the pitch gain codebook including a plurality of entries, each of the plurality of
17 entries including a plurality of terms and a plurality of sums associated with the plurality of
18 terms;

19 wherein the generating a plurality of quantized fixed codebook parameters
20 comprises:

21 generating a first modified target signal based on at least information
22 associated with a first target signal;

23 locating a first plurality of pulse positions and signs for a plurality of
24 pulses in a subframe based on at least information associated with the first modified target
25 signal;

26 estimating a fixed codebook gain for the subframe based on at least
27 information associated with the first plurality of pulse positions and signs;

28 generating a second plurality of pulse positions and signs for the
29 plurality of pulses based on at least information associated with the first modified target
30 signal, an impulse response signal and the estimated fixed codebook gain.

1 27. The method of claim 26 wherein the generating a plurality of quantized
2 LSP parameters further comprises modifying at least one frequency of at least one of the
3 plurality of interpolated LSP parameters in response to the overflow signal.

1 28. The method of claim 27 wherein the modifying at least one frequency
2 of at least one of the plurality of interpolated LSP parameters comprises:
3 increasing the at least one frequency if a first sum associated with the first K
4 LSP parameters of the plurality of interpolated LSP parameters is larger than a first
5 predetermined value;
6 decreasing the at least one frequency if a second sum associated with the last
7 K LSP parameters of the plurality of interpolated LSP parameters is larger than a second
8 predetermined value;
9 wherein K is a positive integer.

1 29. The method of claim 27 wherein the modifying at least one frequency
2 of at least one of the plurality of interpolated LSP parameters is substantially free from a
3 degradation of a signal quality.

1 30. The method of claim 27 wherein a decoder of the destination codec is
2 free from a signal overflow.

1 31. The method of claim 26 wherein the generating a plurality of quantized
2 LSP parameters further comprises:
3 quantizing the plurality of interpolated LSP parameters based on at least
4 information associated with a plurality of quantization tables related to a destination codec;
5 decoding the quantized plurality of interpolated LSP parameters;
6 processing information associated with ordering and spacing between a first
7 parameter and a second parameter of the decoded plurality of interpolated LSP parameters,
8 the first parameter and the second parameter being adjacent to each other.

1 32. The method of claim 31 wherein the generating a plurality of quantized
2 LSP parameters further comprises modifying the decoded plurality of interpolated LSP
3 parameters.

1 33. The method claim 26 wherein the generating a plurality of quantized
2 adaptive codebook parameters comprises:

3 generating a second target signal;
4 generating a plurality of candidate pitch lag values;
5 generating a plurality of candidate signals based on at least information
6 associated with the adaptive codebook and the plurality of candidate pitch lag values;
7 determining a set of dot products of the second target signal and delayed
8 versions of the plurality of candidate signals or of the delayed versions of the plurality of
9 candidate signals;
10 generating a vector signal associated with at least the set of dot products;
11 determining a dot product of an entry associated with the first pitch gain
12 codebook and the received vector signal,
13 processing at least information associated with the dot product and a
14 predetermined value;
15 outputting an index of a selected codevector and an adaptive codebook pitch
16 lag associated with the selected codevector;
17 storing the index of the selected codevector and the adaptive codebook pitch
18 lag.

1 34. The method of claim 33 wherein the second target signal is in a speech
2 domain, a weighted speech domain, an excitation domain, or a filtered excitation domain.

1 35. The method of claim 33 wherein the plurality of candidate signals are
2 associated with a residual domain target signal and free from a synthesis.

1 36. The method of claim 26 wherein the generating a plurality of quantized
2 fixed codebook parameters comprises:

3 generating the first target signal based on at least information associated with
4 an adaptive codebook contribution and an adaptive codebook target signal;

5 generating a fixed codebook vector based on at least information associated
6 with the second plurality of pulse positions and signs;

7 determining fixed codebook indices for the subframe based on at least
8 information associated with the second plurality of pulse positions and signs.

1 37. The method of claim 26 wherein the generating a second plurality of
2 pulse positions and signs for the plurality of pulses comprises:

3 locating at least one position and one sign of at least one pulse in a track;

4 generate a first updated target signal to remove a contribution of the at least
5 one pulse from the first target signal;

6 generating a second modified target signal based on at least information
7 associated with the first updated target signal;

8 storing the at least one position and one sign of the at least one pulse;

9 outputting the second plurality of pulse positions and signs for the plurality of
10 pulses.

1 38. The method of claim 26 wherein the first target signal is in a speech
2 domain, a weighted speech domain, an excitation domain, or a filtered excitation domain.